Why We Don't Report "Zeros" When Measuring Radioactivity

Professional Personnel

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When measuring the amount of radioactivity in environmental samples, this amount is sometimes so small that the method of detection cannot clearly identify whether any radioactivity is present. This uncertainty is primarily due to the:

- Presence of Background Radioactivity
- Limits of Precision for a Detection System

BACKGROUND RADIATION

Background radiation is the sum of the radiation from natural and man-made sources. Natural background radiation is that which is naturally and inevitably present in our environment. Levels of natural background radiation are found everywhere, though this level can vary greatly. People living in granite areas or on mineralized sands receive more terrestrial radiation than others, while people living or working at high altitudes receive more cosmic radiation. A lot of our natural exposure is due to radon, a gas which seeps from the earth's crust and is present in the air we breathe.

Man-made radiation is that which is present in our environment from sources such as medical, commercial and industrial activities and fallout from nuclear weapons testing.

Since background radiation levels exist everywhere, any environmental sample analyzed will show some "level" of radioactivity. Samples, called background samples, are obtained from known unaffected areas in proximity to an area of concern. These background samples are analyzed and values for the background radioactivity levels are determined. Since background radiation varies from location to location so does the level or value of background radioactivity. **Background radioactivity levels are the levels of radioactivity present without any contribution from the radioactive source of interest, such as a hospital, nuclear power plant or accident site.** If samples obtained from the area of concern show activity levels above this background activity level, then there has been a contribution of radioactivity from a source other than background. This contribution is determined by the amount of additional radioactivity present. If the activity level in the sample is similar to the background activity levels then there has not been a contribution from another source.

DETECTION SYSTEMS

The limits of precision for a detection system are derived from the statistical theory of hypothesis testing, taking into account the detector efficiency and quantified as the Minimum Detectable Activity (MDA).

The MDA is the smallest quantity of radioactivity that can be reliably detected in a sample on that detection system. The MDA is calculated based on the amount of background activity measured in a background sample. The MDA determines how much activity must be present in the sample of interest to reliably distinguish it from background.

If the result of a radioactivity measurement is less than the MDA, there is not much confidence that any radioactivity is actually present, and the result is often reported as 'less than detectable'. If the result is greater than the MDA, then there is confidence that radioactivity is present and numerical results are reported.

Source

Office of Radiation Protection, Washington State Department of Health

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